Course Notes: Needle Holders

Introduction to Needle Holders

The needle holder is an instrument primarily used to perform suturing. Needle holders serve two important functions:

1. To hold and push the needle, with its attached suture, through tissues
2. To assist in tying knots in the suture

The jaws of needle holders are traumatic; therefore, needle holders should never be used to handle tissue. Similarly, needle holders should not be used to clamp a suture that the surgeon intends to include in a stitch, as this greatly weakens the suture strand.

General surgeons spend more time using needle holders than just about any other surgical instrument. Suturing with a needle holder is a succession of maneuvers with inherent opportunities to be either time-inefficient or time-efficient with each step. It is very important to learn how to use needle holders properly, since inefficient use accounts for more time lost in surgery than poor technique with other instruments.

In this module, we will examine the types of needle holders available, how to grip a needle holder, and how to properly use needle holders to stitch in an effective and time-efficient manner.

Anatomy of a Needle Holder

Jaws

The jaws of needle holders, located at the tip of the instrument, usually have a roughened surface. This surface helps to grip the needle, preventing rotation or slipping.

Ratchet

Most needle holders have a ratchet mechanism located near the rings. When engaged, the ratchet helps the surgeon maintain their grip on the needle during suture passage.

Rings

Needle holders with rings are made specifically for use with either the right or left hand. To identify whether an instrument is configured for right- or left-handed use, hold the driver in your right hand. With right-handed needle holders, the ratchet ridges on the thumb ring will face the palm. The opposite is found with left-handed drivers. However, many left-handed surgeons learn to use the right-handed needle holders since these are routinely supplied in surgery packs.

Types of Needle Holders

Needle holders, sometimes called needle drivers, are available in several different styles. One of the main differences relates to the jaws of the instrument, commonly referred to as the beak. Most jaws have a roughened surface to prevent slipping or rotation of the needle. The size of the jaws, however, varies greatly to suit the intended purpose. Needle holders used for suturing heavy fascia or skin have stout jaws, whereas those used for grasping finer needles to suture small structures like vessels or ureters, have more delicate jaws and slender handles. Gold handled needle holders come with strong, replaceable carbide inserts that reduce the surface wear at the jaw tips, prolonging the life of the instrument. However, keep in mind that carbide is brittle and can crack if the jaws are inappropriately used to twist wire or hold bone. Unlike scissors with carbide inserts, however, the inserts in needle holders can be replaced when worn out.

Another variation among needle holders relates to the handles. To reach deep, remote areas, longer handled needle holders are useful. Learn more about the types of needle holders commonly used in veterinary surgery below.

Mayo-Hegar

Mayo-Hegar is the most commonly used needle holder in veterinary surgery. These needle holders have two short, blunt, serrated beaks. Some come with a groove in each beak to help provide space for the placement and retention of the needle. There is also a ratcheted locking mechanism at the end of the handles. This

ratchet keeps the jaws closed and securely holds the suture needle in the correct position.

Olsen-Hegar

Olsen-Hegar needle holders are combination needle graspers and suture cutters. They are often chosen by solo surgeons, who wish to pass interrupted sutures and cut the knot ears with the same instrument. Although this instrument may enable the surgeon to perform multiple tasks without changing instruments, there are several limitations to using this instrument. The first limitation is that the scissor cutting area is part of the jaw section of these needle holders. This weakens the jaws significantly, predisposing them to bending, which is commonly referred to as being "sprung." Another potential problem is that uncontrolled excess suture or tissue might inadvertently be cut when the surgeon opens and closes the jaws during needle passage. Lastly, because the cutting area is located behind the jaws of the instrument, cutting cannot take place at the tip, as is recommended when using scissors. Consequently, the surgeon must concentrate on lining up the suture in the depths of the jaws rather than at the tips, as is optimal when cutting suture.

Castroviejo

Castroviejo needle holders are delicate instruments characterized by very small, narrow jaws. These needle holders are appropriate for work on small vessels, nerves, and delicate structures around the eye.

Gripping Needle Holders

In this topic, we will explore the proper methods for gripping needle holders. There are four distinct grips used with needle holders, each having their own mechanical advantages and disadvantages when used in surgery. Let's take a closer look at each of these grips and their surgical applications.

Thumb-Ring Finger Grip (Tripod Grip)

The thumb-ring finger grip, also known as the tripod grip, is most suitable for general needle-holder use. This grip allows for good control of the needle holder. As with other ringed instruments, the tripod grip requires only the tips of the thumb and ring finger to be inserted into the rings. This allows the surgeon to rapidly withdraw the fingers from the rings, or to easily shift to another grip for added stability or speed.

The technique to release the needle-holder jaws using the tripod grip varies according to whether the surgeon is right- or left-handed. With a right-handed needle holder, the ratchet is released by pushing the thumb ring away from the palm. For a left-handed surgeon using right-handed drivers with the left hand, the ratchet release is awkward, and the surgeon must push with the ring finger and pull out with the thumb to release the ratchet.

A major advantage of the tripod grip is that releasing the needle can be done precisely, without undue stress to the tissue. The spring tension on the ratchet is gradually released before distracting the jaw teeth. This is very helpful when handling friable tissue, as uncoordinated or jerky release and regrasping of the needle can result in tearing of tissue with potentially disastrous results.

The main disadvantage of the tripod grip is that pronation of the wrist during needle passage is reduced, limiting the range of motion of the hand and arm during suturing.

Palmed Grip

The palmed grip is the strongest needle-holder grip. It provides the greatest force when driving a needle through very tough tissue, such as cowhide, cartilage, tendons, and bone. With this grip, the handles and rings of the needle holder are held against the palm of the hand with the middle, ring, and little fingers, and the thumb wrapped around the instrument. The index finger is typically oriented along the top of, and parallel to, the needle holder's handles. The thumb and ring finger are closer to the jaws of the instrument than with the tripod grip, giving more control over needle movement. The needle holders can be rotated in the palm of the hand between the thumb and ring finger, which allows pronation when beginning a stitch, and supination when extracting the needle. The major disadvantage of the palmed grip is that is does not allow release and regrasping of the needle without adjusting to another grip. Changing the grip in the middle of needle passage stresses tissue and might dislodge the needle. Grip changing is acceptable when suturing tough tissue, but is unacceptable with fragile structures where tearing can occur.

Thenar Grip

The thenar grip is a versatile needle-holder grip. It allows for good mobility, and ranks between the tripod grip and palmed grip in terms of both strength and direction control. In this grip, the thumb ring is positioned on the ball of the thumb, known as the thenar eminence. Either the ring or little finger can be inserted into the other ring.

The greatest advantage of the thenar grip is that it saves time during continuous suturing, by eliminating some of the suturing steps required with the other grips. The needle can be released and regrasped for extraction without changing grips, which is necessary with the palmed grip.

The major disadvantage of the thenar grip is the lack of precision and control in releasing the needle. To unlock the needle holders, the ball of the thumb pushes the shaft by the ring, while the ring finger pulls the opposite handle towards the palm. This releases the needle suddenly and the spring tension pops the handles apart. This less controlled needle release might lead to undesirable erratic motion of the needle, which may cause tissue tearing. Because of this "pop" release, the thenar grip is not recommended for precise suturing of delicate tissues.

Pencil Grip

Castroviejo needle holders are delicate instruments that are gripped and used in a unique manner. These needle holders are held in a pencil grip, between the thumb and index finger. The grip is close to the jaws and the fingers provide precise control, allowing for very fine suturing. Since the fine motion of the fingers allows for superior control, this grip is most often used for delicate microvascular work and ophthalmic applications.

To create a stitch using Castroviejo needle holders, the instrument is rotated on its axis between the index finger and thumb. For a right-handed surgeon, the rotation is in a clock-wise direction, and is counter-clockwise if the instrument is being held in the left hand. In both cases, the middle finger will "roll" off and away from the needle holders as the stitch is performed. To release the needle, only finger pressure is used to release the lock, resulting in a highly controlled needle release. If necessary, the non-dominant hand can also be used to provide additional support for the needle holder. Surgeons also commonly brace their arms and wrists on the table surface or patient when using Castroviejo needle holders. This practice helps to eliminate shake and unnecessary hand motion.

The main advantage of Castroviejo needle holders is that only finger pressure is required to precisely control needle release. Unlike other needle holders, no hand or wrist movements are utilized.

How to Grasp the Needle in Needle Holders

Placing a stitch requires a sequence of carefully planned steps. Each step, if performed incorrectly, contributes to the loss of precious operative time. Skilled surgeons do not necessarily suture with rapid hand motions, but use deliberate, disciplined steps that eliminate nonproductive motions during suturing. Novice surgeons must practice handling the needle holder and placing sutures in order to learn how to perform this technique properly and efficiently. In this topic, we will examine the first step of placing a stitch, how to grasp the needle within the jaws of the needle holder.

To grasp the needle in the needle holder, release the ratchet and open the jaws. The needle is positioned between the jaws, at the tip of the instrument, and is almost always held perpendicular to the axis of the jaws. This standard position allows for good needle stability and helps prevent bending. When the needle is held in this manner, the needle can be driven through tissue by merely rotating the holder on its axis. This minimizes the amount of motion needed to drive the needle, using less space to complete the stitch. When the needle is placed obliquely within the jaws, the handle of the holders must move through a wider arc to follow the curve of the needle through the tissue. There are few surgical situations in which oblique placement of the needle is required.

When grasping the needle with needle holders, you will also need to plan where along the curve of the needle it should be grasped. The needle can be grasped anywhere in the middle half of the needle arc. Normally, the needle is grasped about two thirds of the way from the tip. However, the needle can be grasped closer to the point, depending on the length of needle required to span the wound and the amount of force needed to penetrate the tissue. In soft tissues, the needle is usually grasped between the midpoint and two thirds away from the needle point, while in tough tissues, the needle is grasped closer to the needle tip, between one third and half way along the needle.

Positioning the needle near the swage allows a greater length of needle to be inserted through the tissue. This helps to reduce the likelihood of the needle backing out of the tissue when the needle is released from the jaws. It is also best for more needle to be exposed on the second side of a stitch in order to avoid regrasping the needle near the sharp tip. Grasping the needle near the tip should be avoided, as this leads to needle dulling. The main disadvantage of grasping the needle close to the swage, is that more torque is placed on the needle during passage through dense tissue. This torque increases the risk of needle breakage or bending.

Positioning the needle within the needle holder near the sharp needle tip has its own advantages and disadvantages to consider. The closer to the point the needle is grasped, the greater the driving force that can be used without bending or breaking the needle. However, sometimes the needle must then be repositioned in the needle holder. When driving a needle through tough tissue, the needle is first advanced using a stabbing motion. Then, the needle is repositioned multiple times, closer to the swage, in order to complete the stitch.

Steps for Performing a Forehand Stitch

There are nine steps required to skillfully perform a forehand stitch. In this topic, we will examine each of these steps.

The first step in performing a forehand stitch is to correctly position the needle in the needle holder. When deciding on the positioning, keep in mind the factors previously discussed, such as the width of the wound and the type of tissue being sutured.

The second step is to grasp the needle holder using one of the four needle holder grips. When selecting a grip, consider the amount of force needed to penetrate the tissue, in other words, consider the tissue density and how accurate the tissue bites need to be.

In the third step, position the free end of the suture away from your side of the field or towards an assistant.

The fourth step begins with determining the proper point of needle placement. When taking the forehand stitch, approach the tissue from the opposite side, sewing toward oneself in a far-to-near fashion. When you are ready to begin the stitch, place your hand in a pronated position, with your palm slightly away from your body.

This will allow you to rotate the needle through a full 180 degrees of supination.

The next step in placing a stitch involves advancing the needle through the tissue. Using a curved needle, two forces need to be balanced; the driving force pushes the needle forward, and the rotating force keeps the proper needle curve in the tissue. The surgeon must balance each force throughout the needle track. As you complete the drive, try to advance the needle so that as much of the needle shaft as possible is exposed on the near side, in order to facilitate needle extraction.

The next step involved in placing a stitch relates to releasing and extracting the needle. When the needle is released from the jaws of the needle holder, there is a tendency for the needle to retract or dislodge from the tissue. To prevent this problem, you can use tissue forceps to grasp the needle before it is released, being careful to avoid grasping the sharp tip. Alternatively, you can use tissue forceps to hold the tissue on the needle, stabilizing it until the needle holders can be reapplied.

In step seven, regrasp the needle in the needle holders. The main thing to focus on in this step is to regrasp the needle perpendicular to the jaws of the needle holder on the first try. In this position, the needle holders are ready for the next bite, and you do not have to readjust the needle further.

In the next step, the needle is extracted from the tissue. Grasp the needle with your hand in a supinated position, palm facing towards you. This will allow you to extract the curved needle using the full range of motion of your wrist and forearm. Once again, the surgeon uses both rotating and driving forces to perform this maneuver.

When performing a continuous suture pattern, the needle is advanced and pulled out of the tissue just far enough to allow grasping of the midpoint of the needle. Using the supinated position, the next stitch can be made without adjusting the needle in the holder, saving time.

The ninth and final step in performing a forehand stitch is to pull the excess suture through the tissue. On a continuous suture line, pull the suture through the tissue until the desired amount of tension has been established on the suture line. On an interrupted suture pattern, an assistant can facilitate by holding the free end of the suture at the appropriate distance from the wound to facilitate knot tying.

One alternative method to placing stitches worth mentioning is the "single dipping" technique. In "single dipping," the two apposing sides of the wound are sutured without re-loading the needle, as is necessary in "double dipping." "Single dipping" can be performed to save time while suturing, assuming that the needle is long enough to allow for needle extraction. Keep in mind however, that better alignment of tissue can be accomplished if separate bites are taken on each side of the wound, as is done with the "double dipping" technique.

Common Mistakes

As you've seen, there are nine steps to placing a stitch and each step offers the surgeon an opportunity to gain or lose efficiencies. In this topic we will examine the three most common mistakes made by novices. To avoid wasting time in the operating room, learn to avoid these mistakes and concentrate on performing each step of the stitch just once.

Mistake #1

Repositioning the needle's direction, angle, and distance from the swage within the jaws of the needle holder.

Mistake #2

Passing the needle through the tissue repeatedly until choosing the correct location for the next stitch.

Mistake #3

Using more than one re-application of the needle holder when passing or extracting the needle.

Course Credits

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